

## Management of transient ischemic attacks diagnosed by early-career general practitioners:

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**Title:**

Management of transient ischaemic attacks diagnosed by early-career general practitioners: a cross sectional study

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## **Abstract**

### **Background:**

Transient ischaemic attack (TIA) incurs a risk of recurrent stroke that can be dramatically reduced by urgent guideline-recommended management at the point of first medical contact.

### **Aims:**

This study describes the prevalence and associations of new TIA presentations to general practice (GP) registrars and the management undertaken.

### **Methods:**

A cross-sectional analysis of the Registrar Clinical Encounters in Training (ReCEnT) cohort study. GP-registrars from five Australian states (urban to very remote practices) collected data on 60 consecutive patient encounters during each of three six-month training terms. The proportion of problems managed being new TIAs and proportion of TIAs with guideline-recommended management were calculated. Univariate and multivariable logistic regression established associations of patient, registrar and practice factors with a problem being a new TIA.

### **Results:**

1,331 GP-registrars contributed data (response rate 95.8%). Of 250,625 problems, there were 65 new TIAs diagnosed (0.03% [95% CI: 0.02%-0.03%]). GP-registrars were more likely to seek help, generate learning goals and spend more time for a new TIA compared to other problems.

Compliance with management guidelines was modest: 15.4% ordered brain and arterial imaging, 36.9% prescribed antiplatelet medication and 3.1% prescribed antihypertensive medication.

### **Conclusions:**

TIA is a very infrequent presentation for GP-registrars, giving little clinical opportunity to reinforce training program education regarding guideline-recommended management. GP-registrars found TIAs challenging and management was not ideal. Since most TIAs first present to general practice and urgent management is essential, an enhanced model of care utilising rapid access to specialist TIA support and follow-up could improve guideline compliance.



## **Main Text**

### **Introduction**

Transient ischaemic attack (TIA) is an urgent and important problem because the risk of recurrent stroke is up to 15% within 90 days,(1) with the greatest proportion of this risk occurring in the first 48 hours.(2) In Australia, stroke imposes a significant burden, causing 6% of all deaths in 2009,(3) and in 2012 more than 420,000 people were living with disability from stroke.(4) Proven management strategies for TIA can reduce relative risk of subsequent stroke by 80%, but they rely upon rapid assessment of TIA and prompt commencement of secondary prevention.(5) Evidence-based practice guidelines internationally have incorporated these management strategies.(6, 7) For Australian practice, they are detailed in the National Stroke Foundation guidelines (hereafter, guidelines).(8)

The majority of patients with TIA first present to general practice(9) but there is limited evidence describing general practitioner (GP) management of TIA. In Australia this evidence suggests that compliance with guidelines may not be ideal.(10, 11) This poses the question of how early career GPs and GP trainees (known in Australia as GP-registrars) are prepared for managing this condition. GP-registrars essentially practice as independent practitioners (including for test-ordering, prescribing, specialist referral, and billing), although they have recourse to advice and support from experienced GP supervisors within a regionalised national GP training program(12).

Previous research shows that when compared to established GPs, GP-registrars see substantially less chronic disease,(13) and older patients prefer to see their usual GP.(14) Increasing age is a major risk factor for TIA(7) and, unfortunately, patients often do not perceive TIA symptoms to be urgent.(15) It is unknown how these potential influences interact in determining the prevalence of TIA presentations in GP-registrars' clinical experience.

GP training relies upon clinical exposure to disease conditions to reinforce good management practices. Consequently, it is important to know how often GP-registrars see TIA and how they manage it.

## **Aims**

To describe the prevalence of clinically diagnosed new TIA presentations, the associations of practice, registrar and patient factors with new TIA presentations, and the management actions undertaken by GP-registrars.

## **Methods**

### *Participants*

This was a cross-sectional analysis of data from the Registrar Clinical Encounters in Training (ReCEnT) cohort study. Data was from 14 rounds of data collection, 2010-16. The study methodology has been described in detail elsewhere.<sup>(16)</sup> Briefly, ReCEnT is an ongoing cohort study of GP-registrars' in-practice clinical experiences undertaken (2010-2015) in five of Australia's then seventeen regional training organisations (RTOs) and (2016) in three of Australia's current nine RTOs. These encompass urban, rural, remote and very remote practices

### *Procedures*

Participating GP-registrar characteristics and the characteristics of their training practice are documented. Registrars record the details of sixty consecutive patient consultations, representing approximately one week of consultations, once in each of three six-month training terms. In one RTO, registrars in a fourth elective term also participated. Data collection is conducted around the mid-point of the term.

### *Outcome factors*

The primary outcome factor was whether a new TIA problem was encountered for patients aged 18 or over. TIA was defined as an initial clinical diagnosis made by the GP-registrar at first consultation following assessment of a patient presenting with a transient neurological disturbance. Problems addressed in the consultation were coded according to the International Classification of Primary Care, second edition (ICPC-2).(17) New TIA problems were defined by ICPC-2 code K89 001 (transient ischaemic attack), K89 014 (amaurosis fugax), K89 015 (reversible ischaemic neurological deficit) and the problem having been recorded as 'new' by the GP-registrar.

### *Independent variables*

Other variables related to the patient, registrar, practice and consultation.

Patient factors were age and gender.

Registrar factors were gender, training term, and place of medical qualification (Australia or international).

Practice factors included practice size (full time equivalent number of GPs), routinely bulk-bills (that is, there is no financial cost to the patient for the consultation), rurality, and socio-economic status of the practice location. Practice postcode was used to define the Australian Standard Geographical Classification-Remoteness Area (ASGC-RA) classification(18) (the degree of rurality) and the Socioeconomic Index for Areas (SEIFA) Index of Disadvantage(19) of the practice location reported as a decile. The lower the SEIFA score the more disadvantaged the area.

Consultation factors were duration of consultation, whether the registrar sought clinical information or assistance during the consultation (from their GP supervisor, a specialist, other

health professional, or from electronic or hard-copy resources), and whether they generated any 'learning goals' (clinical questions to be pursued after the consultation had finished).

Medications prescribed were classified using the Anatomic Therapeutic Chemical (ATC) Classification codes(20): antiplatelets (B01AC06, B02AC07, B01AC04, A01AD05, N02BA01), anticoagulants (B01AA03, B01AB, B01AE, B01AF), antihypertensives (C02, C03, C07, C08, C09) and statins (C10AA).

#### *Data Analysis*

The proportion of all problems that were a 'new TIA' was calculated with 95% Confidence Interval (95% CI).

#### *Associations of a registrar seeing a 'new TIA':*

Univariate and multivariable analyses were conducted with outcome factor 'new TIA' (compared to all other problems).

Logistic regression was used within the generalised estimating equations (GEE) framework to account for repeated measures within registrars. An exchangeable correlation structure was assumed.

Covariates with a p-value < 0.20 and a relevant effect size in the univariate analysis were included in the multivariable regression model.

Covariates which had a small effect size and were no longer significant (at  $p < 0.05$ ) in the multivariable model were removed from the final model as long as the covariate's removal did not substantively change the resulting model.

#### *Management of TIA:*

The guidelines(8) recommend that a TIA be assessed with urgent imaging of the brain and the vessels supplying it, investigated with basic blood tests and an electrocardiogram, reviewed

by a stroke specialist (within 24 hours for high risk TIA and 7 days for low risk, as assessed by the ABCD2 score), and early initiation of secondary prevention consisting of antiplatelet therapy (or anticoagulant where required), initiation or intensification of anti-hypertensive therapy, and statin therapy. Low risk TIA should be managed in a specialist secondary care setting, but it is recognized that management may need to be in general practice if no specialist service is available. The guidelines specify that blood tests, brain and carotid imaging and ECG should be initiated at the first point of healthcare contact, whether first seen in primary or secondary care. Thus, for presentations of ‘new TIAs’ we calculated (with 95% CIs) the proportion of presentations for which ‘brain imaging’ (computed tomography or magnetic resonance imaging), ‘arterial imaging’ (ultrasound, magnetic resonance angiogram, cerebral angiogram), and ‘blood test’ (being any one of full blood count, electrolytes urea and creatinine, blood glucose, or fasting lipids being requested); the proportion of patients ‘referred’ (to neurologist, general physician, emergency department, or hospital clinic); the proportion of patients for whom prescription was made for secondary prevention medications (being an antiplatelet or anticoagulant, antihypertensive and statin); and, as a proxy for guideline compliance, the proportion of presentations for which there was ‘action taken’ (the patient was either referred or all four of these actions occurred: brain imaging, arterial imaging, electrocardiogram and any one of an antiplatelet, anticoagulant, antihypertensive or statin prescribed). We adopted this approach because we do not have data for pre-existing medications. We expect that for the great majority of patients there will need to be at least one medication change made to comply with guideline recommendations for commencement or dose-intensification of secondary prevention medications.<sup>(5)</sup> We also assumed that referral was urgent and, though not entirely consistent with guidelines, would result in expedited investigation in secondary care.

Analyses were programmed using Stata 13.1 (Statacorp, College Station, TX, USA) and SAS V9.4 (SAS Institute Inc., Cary, NC, USA).

*Ethics approval*

The ReCEnT project has approval from the University of Newcastle Human Research Ethics Committee, Reference H-2009-0323.

## **Results**

1,331 registrars contributed 3,259 rounds of data (response rate 95.8%). The characteristics of registrars and their practices are presented in Table 1: 65.5% of registrars were female, 80.6% were initially qualified in Australia, 83.8% worked in major cities or inner regional areas and 65.9% worked in practices with 5 or more GPs.

There were 250,625 problems (from 154,090 consultations) for patients aged 18 years or over, in the 14 rounds of data collection. Of these, 65 problems (0.03% [95% CI: 0.02%-0.03%]) were new TIA problems in 0.04% [95% CI 0.03%-0.05%] of consultations. TIA (new or old) was addressed in 0.07% [95% CI: 0.06%-0.09%] of consultations.

Characteristics of new TIA problems are summarised in Table 2. Results for the multivariable model are presented in Table 3. It shows GP-registrars were significantly more likely to seek in-consultation help or advice for a new TIA problem, generate learning goals and spend more time compared to other problems. GP-registrars working in an inner regional location were significantly more likely to see a new TIA than their colleagues working in major cities. Older patient age was also significantly associated with a new TIA problem.

Management aspects of new TIA problems are presented in Table 4: brain and arterial imaging was ordered in 15.4%, 38.5% were referred for specialised care, 36.9% had an antiplatelet prescribed but only 40.0% satisfied our “action taken” variable .

## **Discussion**

The proportion of consultations entailing a new presentation of TIA to GP-registrars in our study is very low (0.04%), as is that for TIA new or old (0.07%). This compares to 0.2% for management of TIA by established GPs in an earlier Australian study,(21) which reported all consultations for TIA and did not report specifically on new presentations. In comparison, a UK neurology trainee recorded all diagnoses (5,246) encountered during training – of these 2.1% were TIA and 1.1% were new TIAs.(22) Whilst this is only a single trainee it highlights the gulf of experience between the GP and the expert. Our findings indicate that GP-registrars have little exposure to TIA diagnosis and management. This low exposure may therefore limit opportunity to learn and embed best-practice management to reduce the risk of recurrent stroke.(5)

Our data demonstrates an association between a new presentation of TIA and increasing age which is consistent with the epidemiology of TIA.(7) That GP-registrars working at inner regional practices are more likely to see a new TIA than their major city counterparts is a finding with implications for health services delivery.

The multivariable analysis indicates that managing a new TIA is not straightforward for GP-registrars. The significant associations of a new TIA with longer consultations, increased likelihood of seeking help, and of generating learning goals strongly suggest that GP-registrars find TIA a particularly challenging presentation, consistent with recent qualitative findings(11). GP-registrars are not alone in finding TIA challenging, as there is evidence that established GPs and emergency department physicians find diagnosis difficult.(11, 23) Even agreement between stroke-trained neurologists can be poor for TIA diagnosis.(24) However, having reached a diagnosis of TIA it is reasonable to expect adherence to management guidelines.

There was limited adherence with guideline recommendations for all elements of TIA management with 15.4% ordering brain and arterial imaging, 36.9% prescribing protective antiplatelet medication, 3.1% prescribing antihypertensive medication, and 38.5% being

referred. Only 40.0% of new TIA problems meet our proxy measure for adequate guideline compliance. This suggests management of new TIA problems is far from ideal (even when assuming optimal rapid assessment and management of patients who were referred). There were low proportions of relevant imaging, investigations, and secondary prevention. Our findings are concerning because rapid early management of suspected TIA at first medical contact is an opportunity for effective prevention of recurrent stroke.(5)

### *Limitations and Strengths*

Our study's high response rate, unusual for studies in general practice,(25) is a strength.

The proxy marker for guideline compliance, 'action taken', is an imprecise marker for appropriate management of TIA, as we cannot determine the urgency of referrals, whether patients attended appointments or complied with treatments and investigations. Also, our ascertainment of prescribed pharmacotherapy is limited by our lack of information relating to the patient's pre-existing medications. The EXPRESS study(5) of a TIA clinic in Oxford, UK, demonstrated that after a TIA, antiplatelet therapy was initiated in over 57% of patients, clopidogrel (usually in addition to aspirin) in over 50%, a statin in over 70%, a first antihypertensive medication in over 60% and almost 40% had a second antihypertensive commenced. Consequently, initiation of new medicines or intensification of existing medications would be expected actions in the great majority of new TIAs and our methodology would capture this. In defining 'action taken' we required only one of the secondary prevention medications to be initiated or intensified during the consultation. Guidelines require three classes of medication to be addressed (antiplatelet or anticoagulant, antihypertensive and statin). We also assumed referral to be urgent and to result in expedited investigation. Consequently, our measure would tend to overestimate the compliance with guidelines which makes our finding of less than ideal compliance robust.



The study relies upon the GP-registrar identifying the problem as a TIA, and so our estimate of prevalence of new TIA presentations is subject to a risk of both under-reporting and over-reporting. But our findings of registrars' compliance with recommended investigation, management and referral are robust given that these are contingent upon the registrar's diagnosis at the time of the consultation and that we have consultation-level documentation of the actual clinical behaviour and management choices of the GP-registrars.

### *Implications for practice and further research*

The challenging nature of TIAs for GPs and GP-registrars is not likely to be just because of the inherent complexity of the problem but also because it is a relatively rare general practice presentation (meaning there is little opportunity to reinforce guideline management processes). However, the majority of TIAs do present in general practice(9) and therefore designing a model of care for TIA that enhances the ability of GPs to comply with the guidelines would have the greatest impact upon achieving best practice management of TIA. Increased access to acute TIA clinics would meet this challenge(26), but would be very resource intensive and logistically problematic in many areas, especially in areas outside major cities (including inner regional areas where our data suggests GPs are more likely to be consulted for TIAs). In the absence of urgent access to face-to-face specialist care for many GPs and their patients with TIA, access to real-time specialist advice may be an alternative. A rapid access TIA telemedicine clinic could meet this need and be a major part in transforming care for TIA, as has been achieved with acute stroke care.(27) Rather than suffer diagnostic uncertainty and the risk it represents to compliance with secondary prevention while waiting for specialist review, a telemedicine clinic could offer early confirmation of diagnosis, regardless of geographic location of the patient, plus appropriate and timely follow-up to ensure secondary prevention is firmly established when needed(11). Future research could

assess the utility of a telemedicine TIA service. For GP-registrars our findings also suggest that education regarding early management of TIA is important.

## **Conclusion**

TIA is a challenging problem for both early career GPs and established GPs. However, most patients with a TIA first present to general practice and therefore it is vital that appropriate management is commenced as early as possible in this setting. Given the relatively rare frequency of TIA presentations to an individual GP, an enhanced model of care that provides rapid access to expert TIA support and follow-up in general practice could help achieve best practice management.

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**Conflict of Interest:**

No relevant disclosures

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**Table 1: Demographics of participating registrars and their practices**

Variable	Class	n (%) [95% CI]
<b>Registrar variables (n=1,331)</b>		
Registrar Gender	Male	459 (34.5) [32.0-37.1]
	Female	872 (65.5) [62.9-68.0]
Qualified as a doctor in Australia	No	256 (19.4) [17.3-21.6]
	Yes	1,064 (80.6) [78.4-82.7]
<b>Registrar-term or practice-term variables (n=3,259)</b>		
Registrar Training Term	Term 1	1,226 (37.6) [36.0-39.3]
	Term 2	1,138 (34.9) [33.3-36.6]
	Term 3	819 (25.1) [23.7-26.6]
	Term 4	76 (2.3) [1.9-2.9]
Registrar age (years)	Mean (SD)	32.7 (6.4)
Registrar worked at the practice previously	No	2,320 (72.3) [70.7-73.8]
	Yes	890 (27.7) [26.2-29.3]
Registrar works fulltime	No	715 (22.5) [21.1-24.0]
	Yes	2,463 (77.5) [76.0-78.9]
Does the practice routinely bulk bill	No	2,635 (82.2) [80.8-83.5]
	Yes	571 (17.8) [16.5-19.2]
Number of GPs working at the practice	1-4	1,082 (34.1) [32.5-35.8]
	5+	2,087 (65.9) [64.2-67.5]
Rurality of practice	Major City	1,863 (57.2) [55.5-58.9]
	Inner Regional	867 (26.6) [25.1-28.2]
	Outer regional or remote	526 (16.2) [14.9-17.5]
SEIFA Index (decile) of practice	Mean (SD)	5.6 (2.9)

CI=Confidence Interval; SD=Standard Deviation



**Table 2: Characteristics associated with consultations involving a new TIA**

Variable	Class	New TIA		P
		No	Yes	
Patient gender	Male	85979 (35%)	30 (49%)	0.03
	Female	157785 (65%)	31 (51%)	
Registrar gender	Male	83591 (33%)	26 (40%)	0.30
	Female	166969 (67%)	39 (60%)	
Term	Term 1	96465 (38%)	24 (37%)	0.08
	Term 2	85655 (34%)	28 (43%)	
	Term 3	62741 (25%)	9 (14%)	
	Term 4	5699 (2%)	4 (6%)	
Qualified as doctor in Australia	No	47130 (19%)	15 (23%)	0.44
	Yes	201465 (81%)	50 (77%)	
Practice size	Small	86190 (35%)	24 (37%)	0.80
	Large	157484 (65%)	41 (63%)	
Practice routinely bulk bills	No	202549 (82%)	55 (85%)	0.61
	Yes	44430 (18%)	10 (15%)	
Rurality of practice	Major city	142100 (57%)	29 (45%)	0.005
	Inner regional	66963 (27%)	30 (46%)	
	Outer regional or remote	41329 (17%)	6 (9%)	
Sought help any source	No	213669 (85%)	36 (55%)	<0.001
	Yes	36891 (15%)	29 (45%)	
Learning goals generated	No	199535 (83%)	29 (47%)	<0.001
	Yes	39882 (17%)	33 (53%)	
Patient age	mean (SD)	49 (19)	65 (14)	<0.001
SEIFA index	mean (SD)	5 (3)	6 (3)	0.10
Consultation duration	mean (SD)	19 (10)	31 (13)	<0.001

**Table 3: Univariate and adjusted models for consultations involving a new TIA**

Variable	Class	Univariate		Adjusted	
		OR (95% CI)	p	OR (95% CI)	P
Patient gender	Female	0.57 (0.34, 0.93)	0.03	0.72 (0.42, 1.21)	0.20
Term	Term 2	1.32 (0.75, 2.30)	0.34	1.34 (0.72, 2.51)	0.35
	Term 3	0.57 (0.26, 1.24)	0.16	0.82 (0.35, 1.90)	0.64
	Term 4	2.65 (0.85, 8.22)	0.09	3.41 (0.97, 12.0)	0.06
Rurality of practice	Inner regional	2.19 (1.27, 3.76)	0.005	2.71 (1.44, 5.10)	0.002
	Outer regional or remote	0.72 (0.30, 1.72)	0.46	0.94 (0.33, 2.65)	0.90
Sought help any source	Yes	4.72 (2.85, 7.82)	<0.001	2.38 (1.24, 4.57)	0.01
Learning goals generated	Yes	5.87 (3.60, 9.56)	<0.001	2.90 (1.58, 5.33)	<0.001
Patient age	Per year increase	1.04 (1.03, 1.05)	<0.001	1.04 (1.03, 1.05)	<0.001
SEIFA index	Per decile increase	1.07 (0.99, 1.15)	0.10	1.09 (0.98, 1.21)	0.12
Consultation duration	Per minute increase	1.06 (1.05, 1.07)	<0.001	1.05 (1.04, 1.06)	<0.001

**Table 4: Management of problems diagnosed as a new TIA**

Action	Proportion of new TIAs (95% CI)
Brain imaging	27.7% (18.0%-40.1%)
Arterial imaging	24.6% (15.5%-36.8%)
Brain and arterial imaging	15.4% (7.3%-26.6%)
Blood test (any one of full blood count, renal function, blood glucose, fasting lipids)	16.9% (9.5%-28.4%)
Electrocardiogram ordered	7.7% (3.2%-17.5%)
Referred	38.5% (27.2%-51.1%)
Antiplatelet prescribed	36.9% (25.9%-49.5%)
Antihypertensive prescribed	3.1% (0.7%-11.9%)
Statin prescribed	4.6% (1.5%-13.7%)
Anticoagulant prescribed	0.0%
Action taken (patient either referred or all of brain imaging, arterial imaging, electrocardiogram and any one of antiplatelets, anticoagulants, antihypertensives or statins prescribed)	40.0% (28.6%-52.6%)